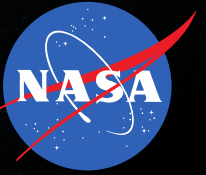
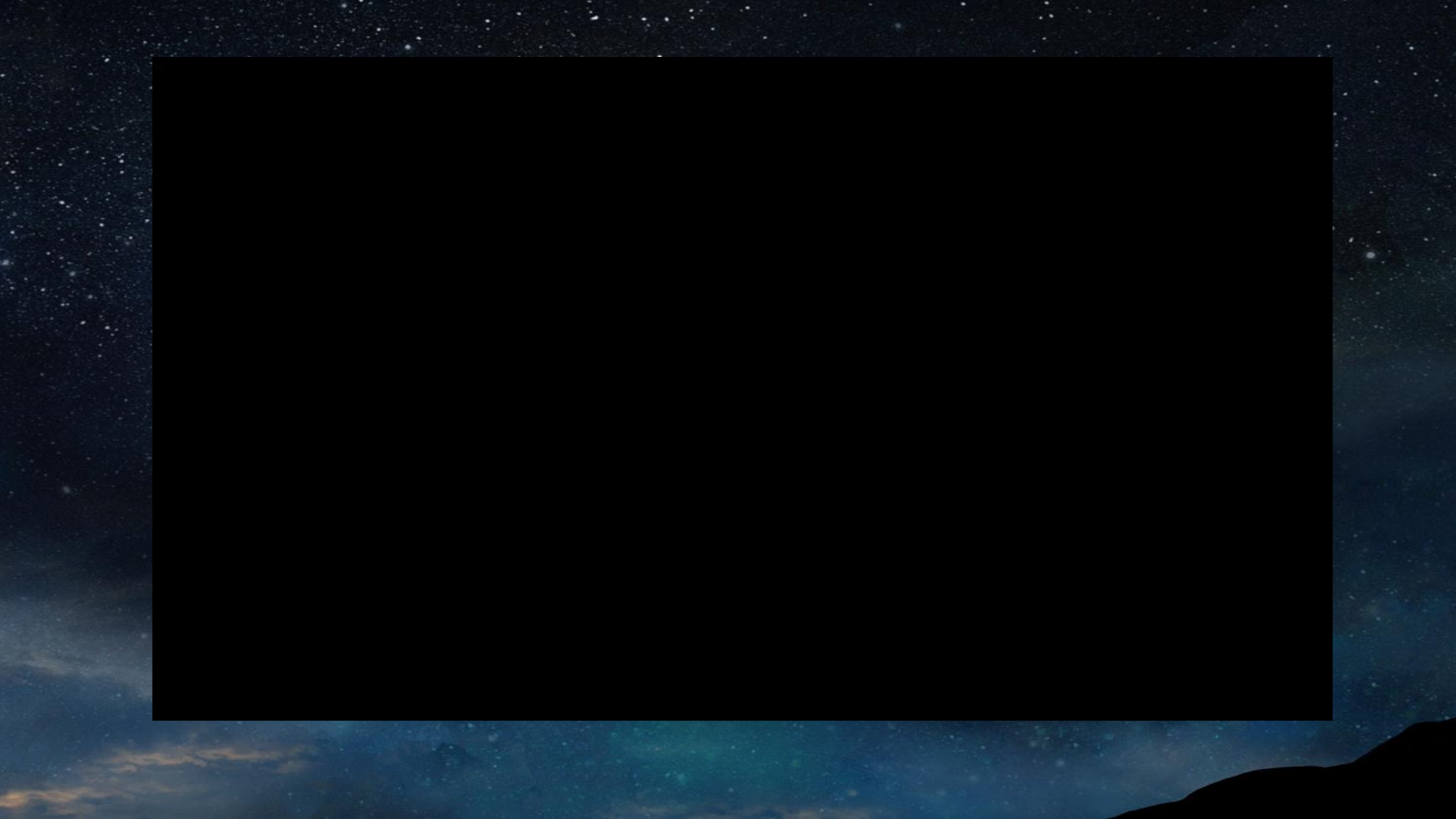


National Aeronautics and
Space Administration



EXPLORE_{as} ONE

Bob Cabana, Director
Kennedy Space Center



Premier Multi-User Spaceport



BOEING



NORTHROP GRUMMAN



SPACEX



LOCKHEED MARTIN



BLUE ORIGIN

KSC Programs and Projects



Commercial Crew Program



Launch Services Program



Exploration Ground Systems



Gateway — A spaceport for human and robotic exploration to the Moon and beyond



Exploration Research & Technology Programs

2019 KSC Key Milestones

✓ March 2	SpaceX Demo-1	LC 39A
✓ June 27	Mobile Launcher rolls testing to SLC 39B	
✓ July 2	Orion Launch Abort System Test	SLC-46
✓ October 10	ICON Mission	CCAFS

Remaining Milestones Planned in 2019

Boeing Pad Abort Test – Target date 11/4/19

Boeing Orbital Flight Test – Target date mid December

SpaceX In-Flight Abort Test – Target date early December

Gateway Logistics Contract Award

2020 KSC Key Milestones

Orion Mass Simulator on dock KSC - 1/24/20

SpaceX Demo-2

Boeing Crewed Flight Test

Solar Orbiter – 2/5/20

SLS Boosters arrive and processing begins - 3/18/20

Orion turnover to EGS - 5/16/20

MARS 2020 -7/17/20

Sentinel 6A - 11/15/20

Landsat-9 – 12/15/20

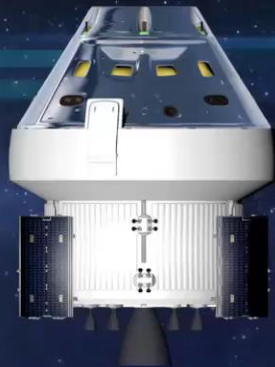


EXPLORE HUMANS *in* SPACE

FOR ALL HUMANITY

EXPLORE

A Tale of **Three** Capsules



NASA
Orion

BEYOND EARTH ORBIT



SpaceX
Crew Dragon

LOW-EARTH ORBIT



Boeing
CST-100 Starliner

National Aeronautics and
Space Administration



COMMERCIAL CREW





SpaceX Demo-1

March 2, 2019



Boeing Hotfire & Parachute Tests

May 22, 2019





ARTEMIS

PHASE ONE:

Lunar South Pole by 2024





Moon Before Mars

On the Moon, we can take reasonable risks while astronauts are just three days away from home.

There we will prove technologies and mature systems necessary to live and work on another world before embarking on what could be a 2-3 year mission to Mars.



The Artemis Program

Artemis is the twin sister of Apollo and goddess of the Moon in Greek mythology. Now, she personifies our path to the Moon as the name of NASA's program to return astronauts to the lunar surface by 2024.

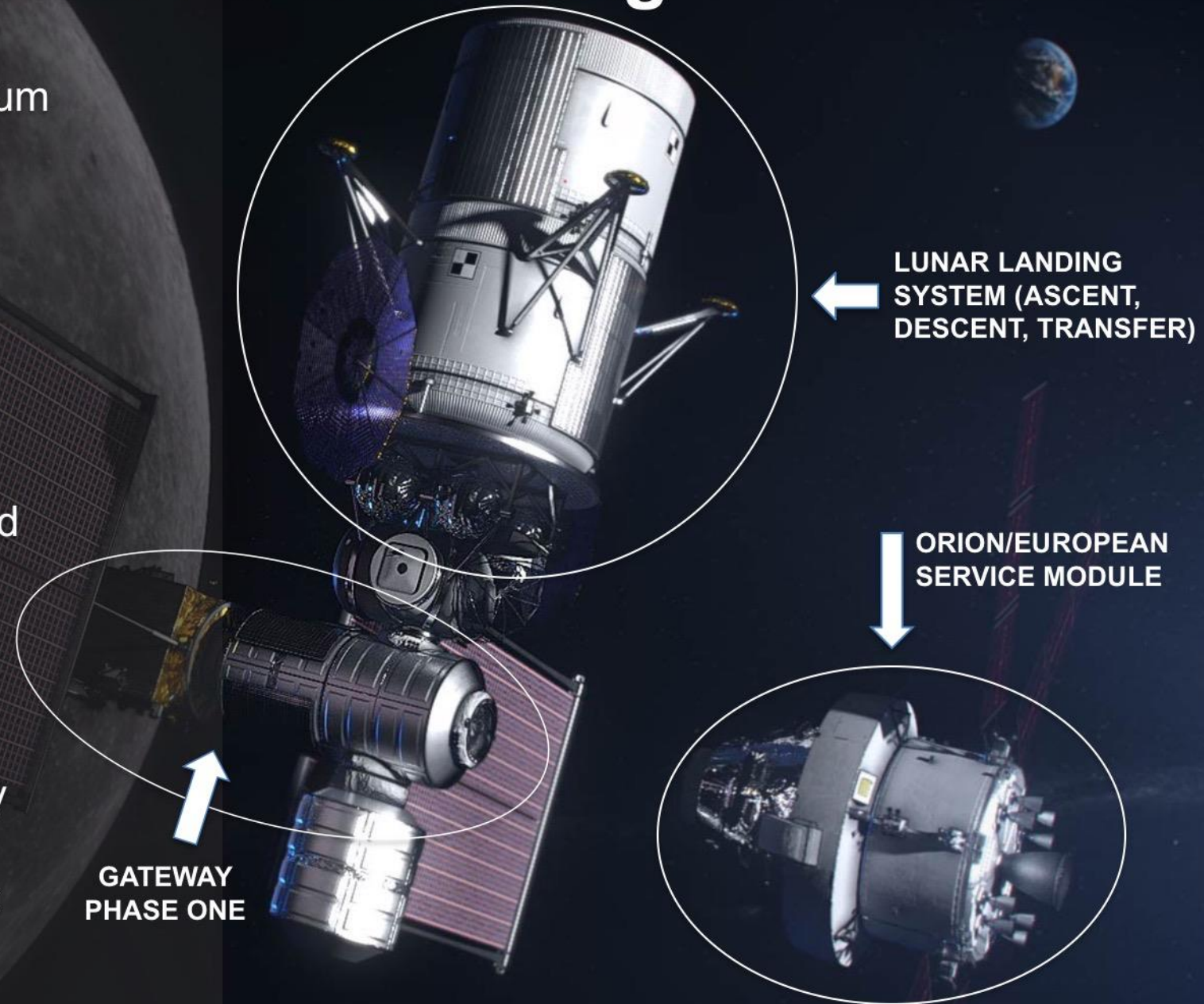
When they land, Artemis astronauts will step foot where no human has ever been before: the Moon's South Pole.

With the horizon goal of sending humans to Mars, Artemis begins the next era of exploration.



Gateway is Essential for 2024 Landing

- Initial Gateway focuses on the minimum systems required to support a 2024 human lunar landing while also supporting Phase 2
- Provides command center and aggregation point for 2024 human landing
- Establishes strategic presence around the Moon – US in the leadership role
- Creates resilience and robustness in the lunar architecture
- Open architecture and interoperability standards provides building blocks for partnerships and future expansion



Artemis Phase 1: To The Lunar Surface by 2024

Artemis I: First human spacecraft to the Moon in the 21st century

Artemis II: First humans to orbit the Moon in the 21st century

Artemis Support Mission: First high-power Solar Electric Propulsion (SEP) system

Artemis Support Mission: First pressurized module delivered to Gateway

Artemis Support Mission: Human Landing System delivered to Gateway

Artemis III: Crewed mission to Gateway and lunar surface

Commercial Lunar Payload Services

- CLPS-delivered science and technology payloads

Early South Pole Mission(s)

- First robotic landing on eventual human lunar return and In-Situ Resource Utilization (ISRU) site
- First ground truth of polar crater volatiles

Large-Scale Cargo Lander

- Increased capabilities for science and technology payloads

Humans on the Moon - 21st Century

First crew leverages infrastructure left behind by previous missions

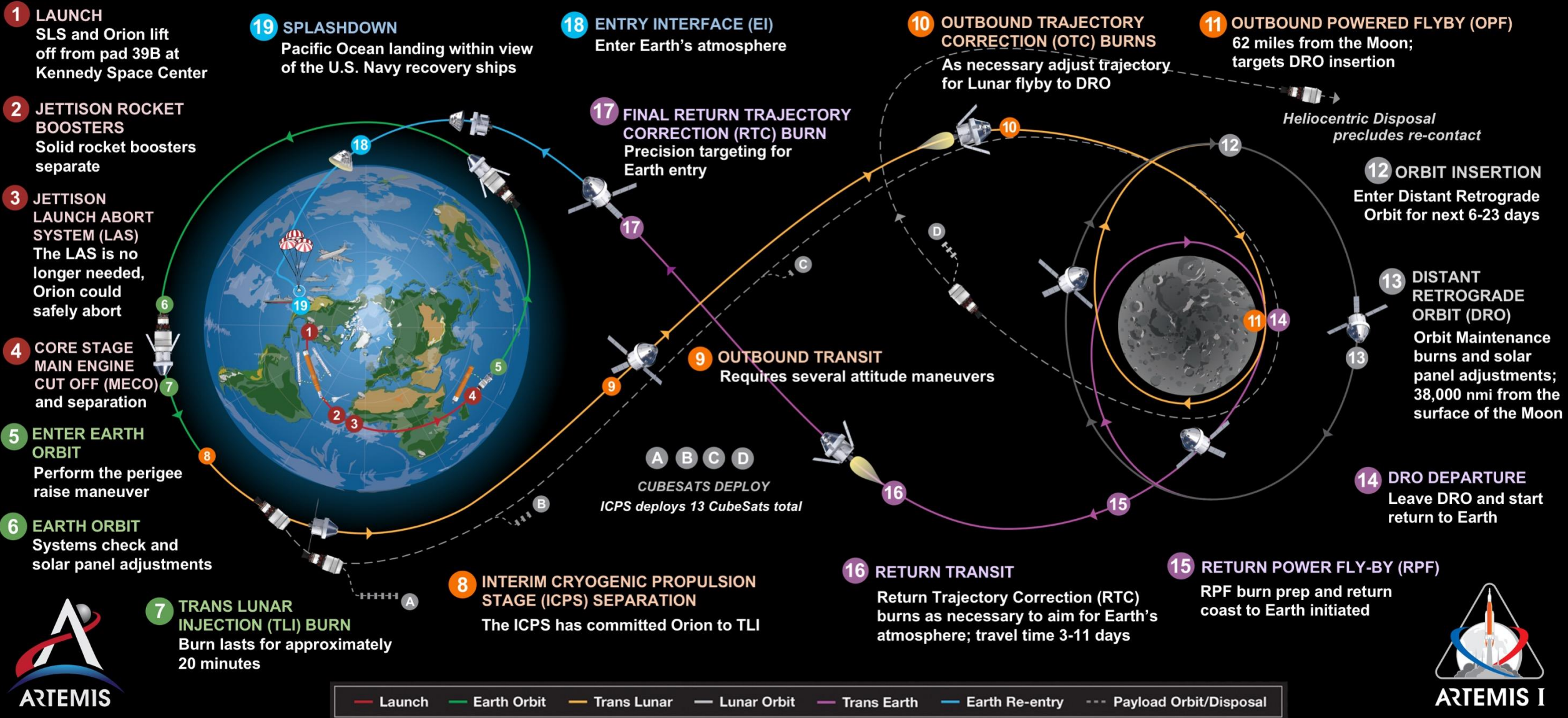
LUNAR SOUTH POLE TARGET SITE

2020

2024

ARTEMIS I

The first uncrewed, integrated flight test of NASA's Orion spacecraft and Space Launch System rocket, launching from a modernized Kennedy spaceport



ARTEMIS I

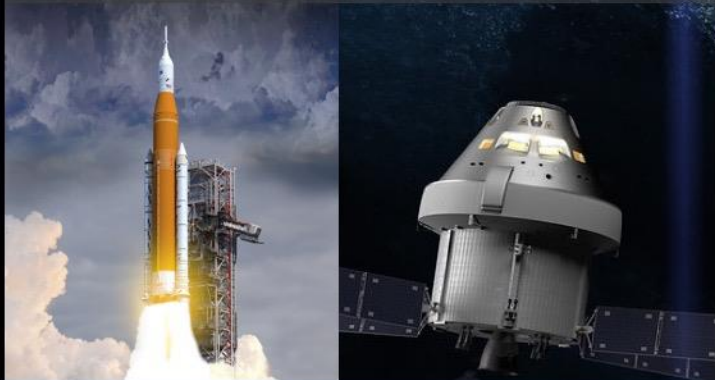
Total distance traveled: 1.3 million miles – Mission duration: 26-42 days – Re-entry speed: 24,500 mph (Mach 32) – 13 CubeSats deployed

Achieving 2024 – A Parallel Path to Success

Artemis will see government and commercial systems moving in parallel to complete the architecture and deliver crew

CREW

NASA Programs SLS and Orion



Artemis I

First flight test of SLS and Orion as an integrated system

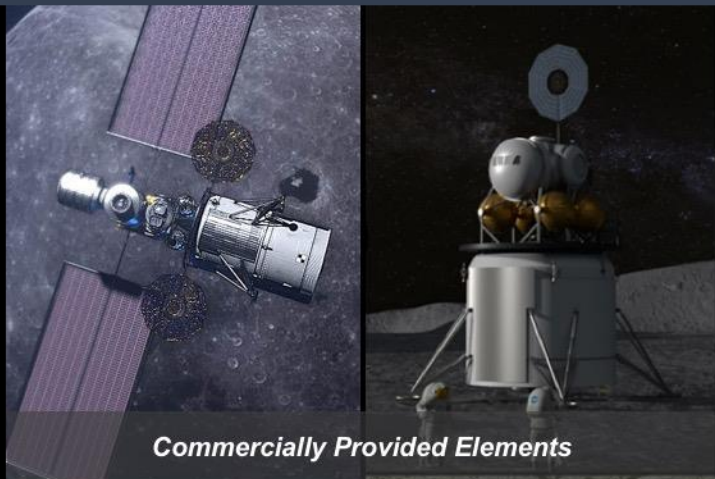
Artemis II

First flight of crew to the Moon aboard SLS and Orion

Artemis III

First crew to the lunar surface; Logistics delivered for 2024 surface mission

Between now and 2024, U.S. industry delivers the launches and human landing system necessary for a faster return to the Moon and sustainability through Gateway.



Commercially Provided Elements

CARGO

PPE

Power and Propulsion Element arrives at NRHO via commercial rocket

Pressurized Module

Small area for crew to check out systems prior to lunar transfer and decent

Human Landing System

Transfer

Transfers lander from Gateway to low lunar orbit

Descent

Descends from Transfer Vehicle to lunar surface

Ascent

Ascends from lunar surface to Gateway

Up to three commercial rocket launches, depending on distribution of the Transfer, Descent, and Ascent functions

Space Technology for 2024 and Beyond

High
Performance
Spaceflight
Computing



Precision
Landing

Solar
Electric
Propulsion



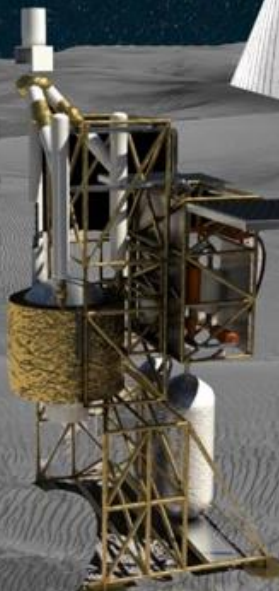
Cryofluid
Management



Lunar Dust
Mitigation



In Situ
Resource
Utilization



Surface
Excavation/Construction



Extreme Environments

Extreme Access



Lunar Surface
Power



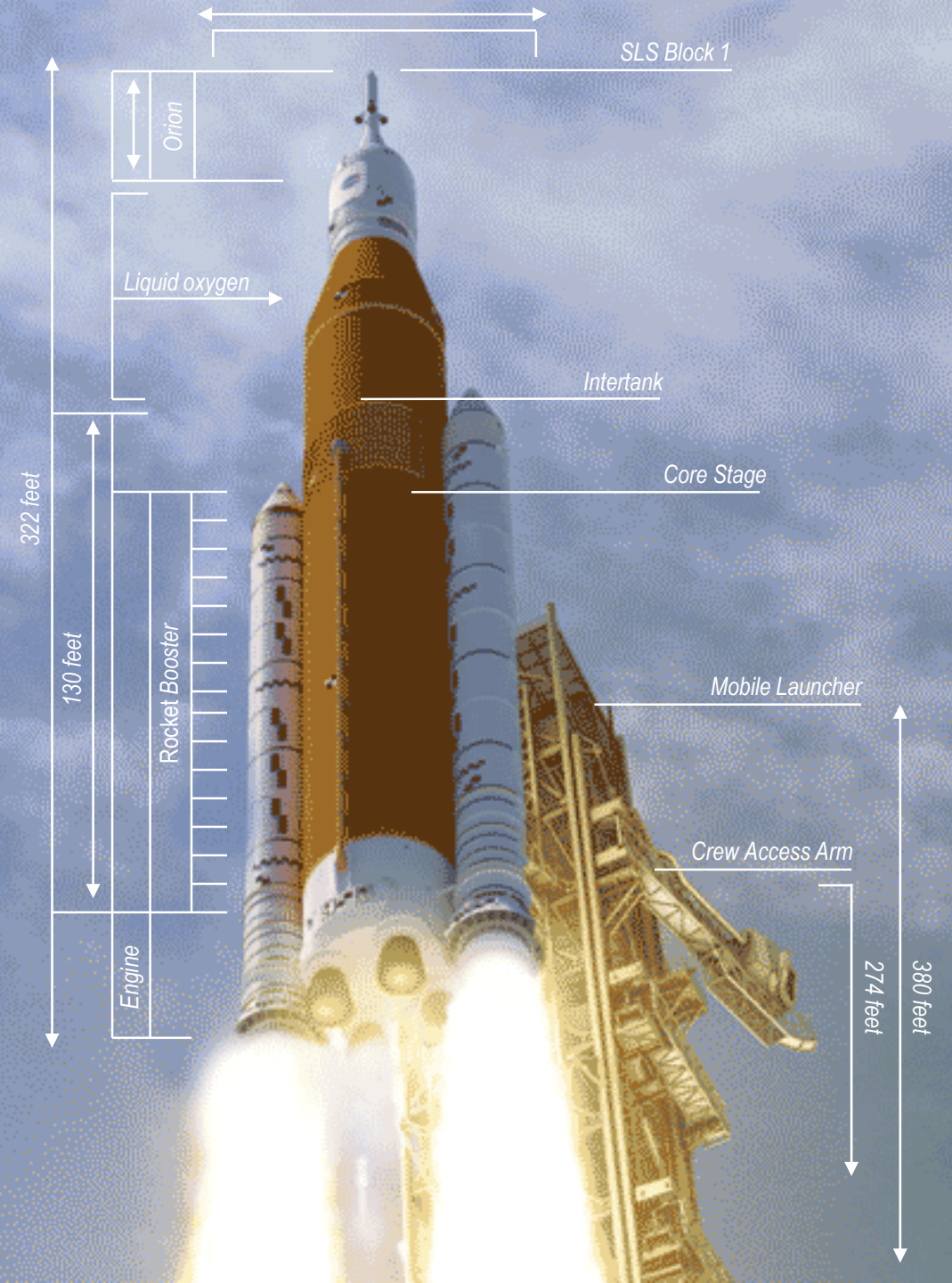
Lunar Surface Innovation Initiative

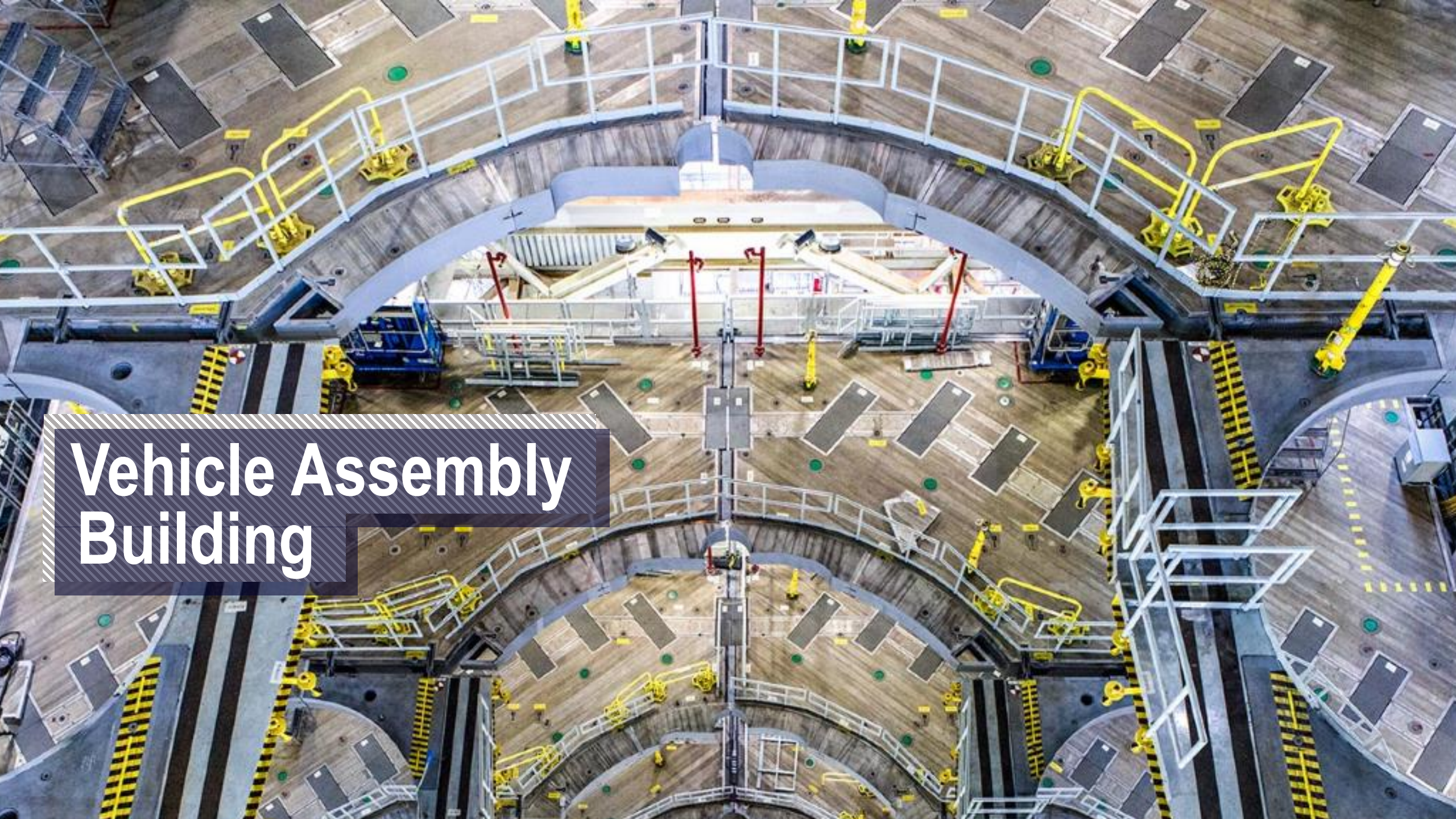
EGS Striving Toward Launch of Artemis I



Artemis I

Exploration
Ground
Systems



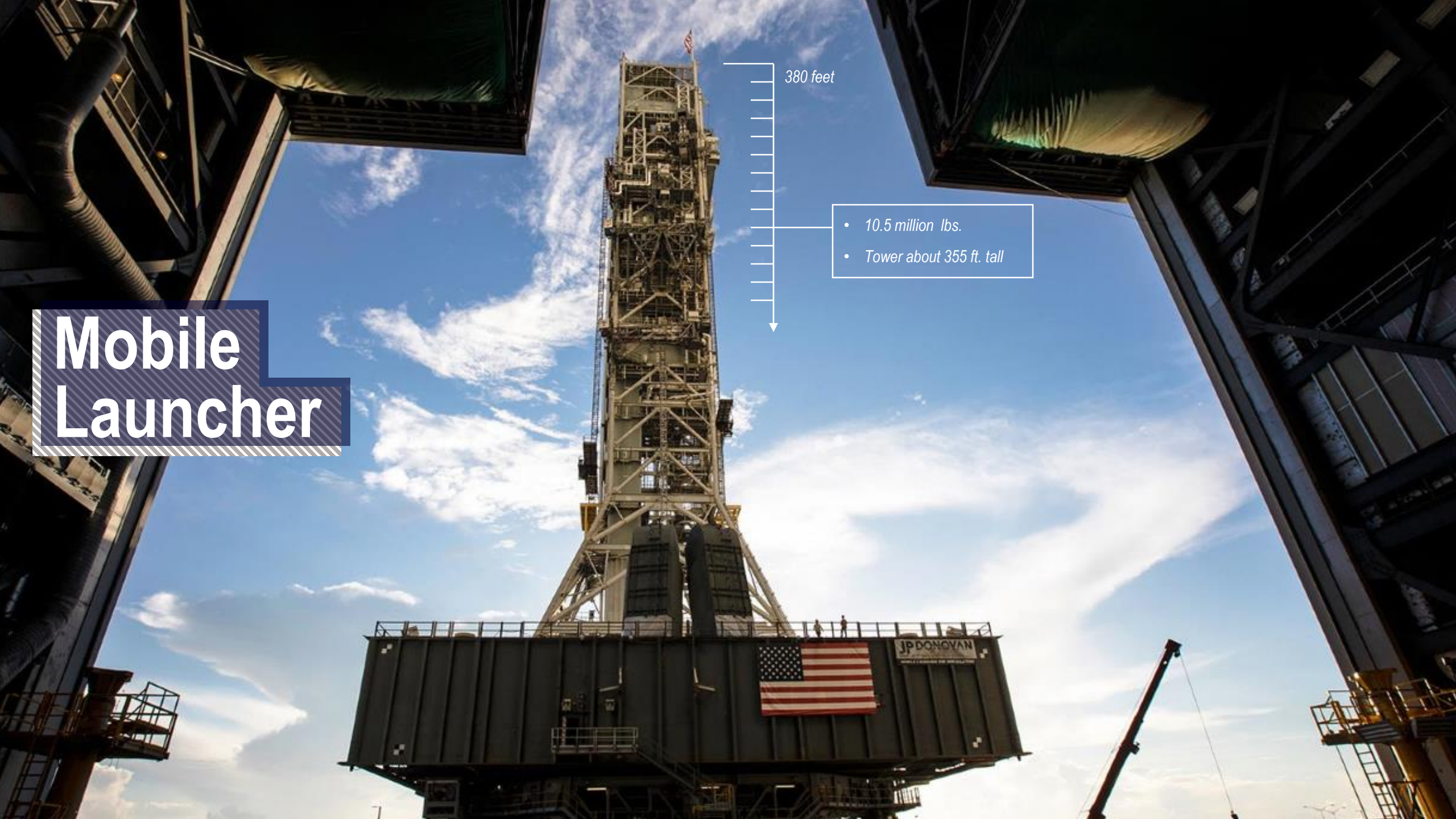


Vehicle Assembly Building

Mobile Launcher

380 feet

- 10.5 million lbs.
- Tower about 355 ft. tall





Launch Pad 39B



Landing and Recovery



U.S. Navy

Orion Test Article

Orion Ascent Abort-2 Flight Test

July 2, 2019



0:39:39
UNIVERSAL TIME

HOLD TIME REMAINING

1:09:39
LOCAL TIME

Firing Rooms and Launch Control



SLS Core Stage Pathfinder

October 15-16, 2019





Launch Services Program Manifest

2019



ICON
Ionospheric Connection Explorer



Venture Class
Launch Services

2020



Solar Orbiter



Mars 2020



Sentinel 6A
(Jason-CS)



Landsat-9

Providing Advisory Services



Commercial Crew
Program



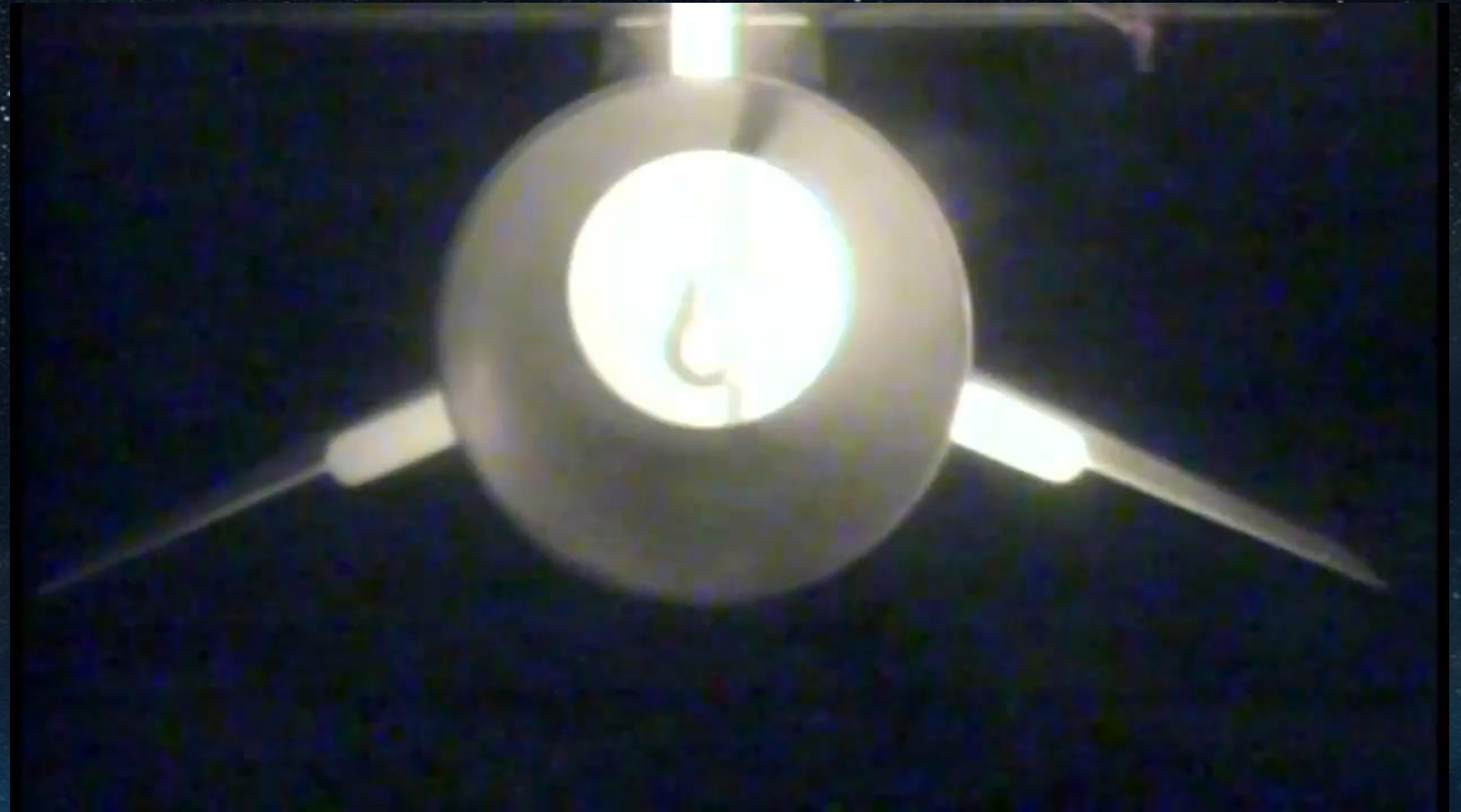
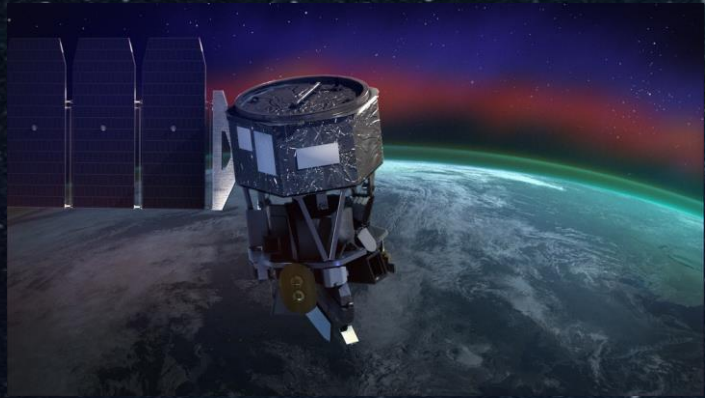
Commercial
Resupply Services



Gateway Logistics

Ionospheric Connection Explorer (ICON)

October 10, 2019



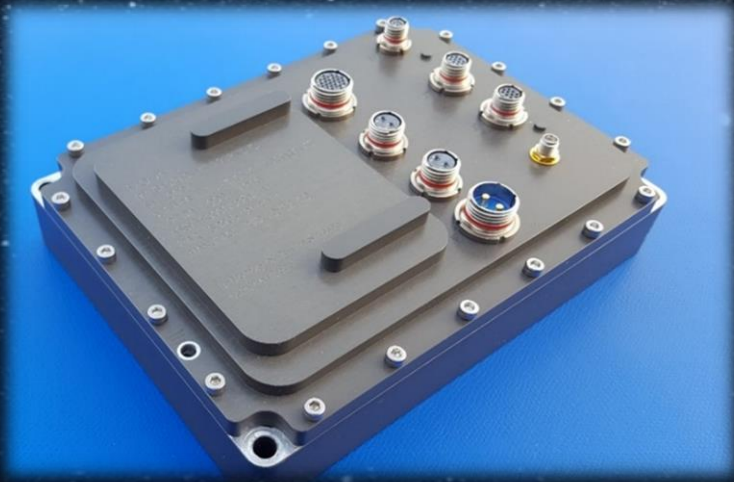
Exploration Research and Technology Programs



**Exploration Research and
Technology Programs**



Exploration Research and Technology - 2019 Awards



FLC Interagency Partnership Award for Technology Transfer

- KSC is the only NASA center to win award in 2019
- The Autonomous Flight Termination System (AFTS) augments or replaces the functions of the traditional human-in-the-loop system
- Allows multiple vehicles to be launched and tracked at the same time
- AFTS transferred to 30+ commercial space companies and other government organizations

NASA's Technology Transfer Licensing Award

- KSC won with 18 patent licenses in FY18
- Patent licensing is one of the ways we transfer NASA technologies to industry

KSC Roadmap – September 2019

2019

2020

2021

2022

2023

2024

Exploration

~ 65 NASA launches, 10+ NASA launches/year

International Space Station

~ 22 ISS launches

~ 14 crewed launches

~ 16 CCP launches

Launch Services

~ 17 LSP launches

Lunar Gateway

~ 5 Gateway launches

~ 4 EGS launches

103 CoF Projects at >\$1B value

~ 7+ launch vehicle fleets

